OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

The Honorable Howard P. "Buck" McKeon
Chairman
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The enclosed report responds to House Report 111–491, page 317, accompanying H.R. 5136, the National Defense Authorization Act for Fiscal Year 2011, which requests the Secretary of Defense submit a report on all health care-related projects or programs that use an interactive virtual agent to help reduce barriers to individuals seeking mental health care. This final report was delayed due to complex coordination and analysis requirements as documented in our interim response, dated March 31, 2011. I apologize for the late submission, but I am pleased to provide this report in advance of the proposed final submission date of September 30, 2011.

This report presents information on all identified Department of Defense-sponsored projects using virtual agents in mental health care. Each of the projects has an interactive virtual agent as the principal technology either in use, or as a feature included in a larger project. The projects are designed for different audiences in order to: (1) accomplish training for first level care for mental health issues; (2) offer information and feedback on various mental health issues to reduce barriers to seeking care; or (3) offer resilience training to deploying Service members.

Thank you for your interest in the health and well-being of our Service members, veterans, and their families.

Sincerely,

Jo Ann Rooney
Principal Deputy

Enclosure:
As stated

cc:
The Honorable Adam Smith
Ranking Member

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

The Honorable Carl Levin
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

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Jo Ann Rooney
Principal Deputy

Enclosure:
As stated

cc:
The Honorable John McCain
Ranking Member

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

The Honorable Jim Webb
Chairman
Subcommittee on Personnel
Committee on Armed Services
United States Senate
Washington, DC 20510

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Jo Ann Rooney
Principal Deputy

Enclosure:
As stated

cc:
The Honorable Lindsey O. Graham
Ranking Member

**OFFICE OF THE UNDER SECRETARY OF DEFENSE**
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

The Honorable Joe Wilson
Chairman
Subcommittee on Military Personnel
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

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Jo Ann Rooney
Principal Deputy

Enclosure:
As stated

cc:
The Honorable Susan Davis
Ranking Member

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

The Honorable Daniel K. Inouye
Chairman
Committee on Appropriations
United States Senate
Washington, DC 20510

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Principal Deputy

Enclosure:
As stated

cc:
The Honorable Thad Cochran
Vice Chairman

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

The Honorable Daniel K. Inouye
Chairman
Subcommittee on Defense
Committee on Appropriations
United States Senate
Washington, DC 20510

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Vice Chairman

**OFFICE OF THE UNDER SECRETARY OF DEFENSE**
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

The Honorable Harold Rogers
Chairman
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

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Jo Ann Rooney
Principal Deputy

Enclosure:
As stated

cc:
The Honorable Norman D. Dicks
Ranking Member

**OFFICE OF THE UNDER SECRETARY OF DEFENSE**
4000 DEFENSE PENTAGON
WASHINGTON, DC 20301-4000

PERSONNEL AND
READINESS

SEP 8 2011

The Honorable C.W. Bill Young
Chairman
Subcommittee on Defense
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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Sincerely,

Jo Ann Rooney
Principal Deputy

Enclosure:
As stated

cc:
The Honorable Norman D. Dicks
Ranking Member

# Report to Congress

# Outreach Tools Using an Interactive Virtual Agent

## House Report 111-491, page 317
## to accompany
## H.R. 5136
## The National Defense Authorization Act
## for
## Fiscal Year 2011

Preparation of this study/report cost the Department of Defense a total of approximately $2,600 in Fiscal Year 2011.

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## Executive Summary

This report is in response to House Report 111-491, page 317, accompanying H.R. 5136, the National Defense Authorization Act for Fiscal Year 2011, which requests the Secretary of Defense submit a report on all healthcare projects or programs that use an interactive virtual agent to help reduce barriers to seeking mental healthcare. This report is inclusive of all known Department of Defense (DoD)-sponsored mental health projects and has been staffed through the Services for accuracy.

Interactive virtual agents are artificial intelligence software. These agents interact with users as a human would, ideally with originality, reciprocity, and continuity. Namely, they are capable of natural language, engaging in face-to-face spoken dialogue with a user in a virtual environment, and exhibiting human-like emotional reactions. Advanced interactive virtual agents can engage in rich conversation, recognize nonverbal cues, reason about social and emotional factors, and synthesize human communication and nonverbal expressions. Such fully embodied conversational characters have been technologically available since the early 1990's but without this level of complexity. Their use has largely been for training, intelligent kiosks in a virtual environment, and as virtual receptionists. Their use commercially and in the DoD is limited as they are a relatively new technology and time intensive to create. Therefore, their use in healthcare is still being explored.

This report covers nine identified DoD-sponsored projects using virtual agents in mental health care. The projects are as follows: (1) Military Virtual Patients (VPs) for Training in Depression/Suicide Issues and for Post-Traumatic Stress Disorder (PTSD) Exposure Therapy Training; (2) SimCoach; (3) JESSEY; (4) Virtual Officer Leadership Trainer (VOLT) and the Immersive Naval Officer Training System (INOTS); (5) Stress Resilience in Virtual Environments (STRIVE); (6) the Warrior's Journey Activity with the Storytelling Agent; (7) National Center for Telehealth and Technology (T2) Virtual Post-Traumatic Stress Disorder (PTSD) Experience; (8) Post-Traumatic Stress Disorder (PTSD)-SIM; and (9) Video Doctor. Each of the projects has an interactive virtual agent as the principal technology either in use or as a feature included in a larger project. The projects all deal with some element of mental health and either: (1) train clinicians and military personnel to give appropriate first level care for mental health issues; (2) have an interactive virtual agent offering information and feedback on various mental health issues (such as suicide, depression, and posttraumatic stress) to reduce barriers to seeking care; or (3) offer resilience training to deploying Service members. The current projects all utilize technology to break down barriers to care by providing Service members, Veterans, and their families with confidential help exploring and accessing psychological healthcare content. These tools do not take the place of mental health providers or offer therapy; they only serve to engage the user around seeking care or act as patients for providers/officers learning therapeutic skills. These projects are relatively novel, and as underlying technologies continue to advance, further opportunities will present themselves for their use and development.

## I. Background

House Report 111-491, page 317, accompanying H.R. 5136, the National Defense Authorization Act for Fiscal Year 2011, requested the Secretary of Defense submit a report on all healthcare projects or programs that use an interactive virtual agent to help reduce barriers to seeking mental healthcare. For the purposes of this report, interactive virtual agent is defined in the following way: *Interactive* is a unique reciprocal interaction between a user and program where the program will respond to a behavior set by the user in a continuous process. A *virtual* agent indicates that the character exists as a virtual presence, imbedded in a virtual environment. An *agent* is defined as a presence that mimics human responses and is a complex software entity that "possesses" or retains a certain level of autonomy or even some level of artificial intelligence[1]. It can learn and reason, and may communicate and cooperate to achieve an objective. Such agents are self-contained and capable of making independent decisions and acting to satisfy "internal" goals based upon their software and the sensed environment. Another name for interactive virtual agents are *virtual humans (VHs)*. Such VHs have been created for use in a variety of applications including: education[2]; training[3]; therapy[4]; and marketing and entertainment. Therefore, an *interactive virtual agent* is an intelligent VH system whose use has been explored in healthcare over the last 15 years[5].

In recent years, research and development projects have produced highly interactive, artificially intelligent, VH agents capable of some natural language capabilities. Some are designed to engage in face-to-face spoken dialogue, respond to information provided by users, recognize nonverbal cues, synthesize human communication and nonverbal expressions, and, in some instances, are capable exhibiting human-like emotional reactions[5].

There are several programs DoD identified that fit the definition of interactive virtual agent. All the below programs are at different stages of development and are accurate descriptions of the projects as of January, 2011. These projects, developed to reduce barriers to seeking mental healthcare or help train clinicians, include:

- Military VP's for Training in Depression/Suicide Issues and PTSD Exposure Therapy Training
- SimCoach
- JESSEY
- VOLT and INOTS
- STRIVE
- Warrior's Journey Activity with the Storytelling Agent

---

[1] Franklin, S., & Graesser, A. (1996). Is it an agent, or just a program? A taxonomy for autonomous agents. In *Proceedings of the third international workshop on agent theories, architectures, and languages*. Heidelberg: Springer

[2] Biswas, G. Leelawong, K., Schwartz, D., Vye, N., & the Teachable Agents Group at Vanderbilt (2005). Learning by teaching: A new agent paradigm for educational software. In *Applied Artificial Intelligence*, 19(3/4), 393-412.

[3] Swartout, W., Gratch, J., Hill, R. et al. (2006). Toward virtual humans. *AI Magazine*, 27(2), 96–108.

[4] Marsella, S., Johnson, W. L., & LaBore, C. (2003). Interactive pedagogical drama for health interventions. In U. Hoppe, F Verdejo, & J. Kay (eds.), *Artificial intelligence in education: Shaping the future of learning through intelligent technologies*. Amsterdam: IOS.

[5] Wang, N. & Rizzo, A.A. (2008). Avatars and Agents. In: The International Encyclopedia of Communication, Donsbach, W. (Ed.).

- T2 Virtual PTSD Experience
- PTSD-SIM
- Video Doctor

## II. Introduction

For the past 15 years, virtual environments have been used for clinical purposes. Advances in computer power, speed, graphics, display systems, body and motion tracking, and interface technology have made the creation of low-cost, computer-based virtual reality (VR) systems possible. Further, with artificial intelligence advances, populating such environments with interactive virtual agents or VHs is more feasible. Although this technology is still relatively new, it may hold significant potential for future developments[6].

Interactive virtual agents are now designed to perceive and interact in a three-dimensional (3D) virtual world. They can engage in face-to-face spoken dialogue with a user, and in some instances can exhibit human-like emotional reactions[6]. Past work on VHs focused on perception and action in the virtual environment, but ignored dialogue and emotions. This is now changing.

Interest in artificially intelligent agents designed to interact with humans in a clinically empathic manner can be traced to the work of Joe Weizenbaum who, in 1966, wrote a language analysis program called ELIZA that was designed to imitate an empathic therapist. The system allowed a computer user to interact with a virtual therapist by typing simple sentence responses to the computerized therapist's questions. Limitations to ELIZA were soon noted due to its inability to handle complex language or nuance[7].

Current clinical use of interactive virtual agents is being considered as a part of medical and psychological interviewing, assessment, diagnosis, and interpersonal training. Further, it is being explored for use in the U.S. military to train providers on how to handle depressed or suicidal Service members. Discussion also includes related emerging work on an online VH presence (SimCoach) for providing assistance to Service members and significant others in the access of relevant psychological health (PH) and traumatic brain injury (TBI) care information. This project aims to break down barriers to care (e.g. unawareness, stigma, and complexity of the military psychological healthcare system) and assist users in the process of initiating a first contact with a live human healthcare provider.

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[6] Rizzo, A. Parsons, T., Buckwalter, G., Lange, B., & Kenny, P. (In press). A new generation of intelligent virtual patients for clinical training. *The American Behavioral Scientist.*

[7] Weizenbaum, J. (1976). *Computer Power and Human Reason.* San Francisco: W. H Freeman.

## III. Current DoD Interactive Virtual Agent Projects

### Project 1: Military Virtual Patients (VPs) for Training in Depression/Suicide Issues and for Posttraumatic Stress Disorder (PTSD) Exposure Therapy Training [8, 9]

This training tool is designed for teaching clinicians and other Service members how to recognize the potential for a suicidal occurrence. Such training is meant to increase their comfort and effectiveness with such groups. It combines two past VPs, Justin and Justina, who were used to inform military clinical training. In this project, Justin and Justina, appear as military Service members who are depressed and possibly contemplating suicide. A related component of this project focuses on Justina, a sexual assault survivor, with the aim of developing a training tool with which clinicians can use to practice sensitive interviewing skills for addressing sexual assault in the military. The system is also being designed for use by Command staff to foster better skills for recognizing the signs of sexual assault and for improving the provision of support and care.

Both military VP versions will be used for Service members undergoing the standard of care treatment for PTSD, called exposure therapy. The project aims to use the VPs to train therapists in skills required for traditional imaginal exposure therapy and the promising emerging treatment tool used in VR-delivered exposure therapy. Traditional imaginal exposure therapy is an evidence-based treatment for PTSD involving exposing clients to images of their trauma and real world, non-threatening experiences they are avoiding. In the imaginal exposure version, the VPs will be programmed with a variety of trauma narrative content. The trainees will then have the opportunity to practice the skills that are required for appropriately fostering emotional engagement to promote optimal therapeutic habituation during exposure therapy sessions. In the VR exposure system, the VP will appear in a simulation of a therapy room wearing a VR head mounted display. In this version, the clinician will be given training in how to use the *Virtual Iraq/Afghanistan* interface controls and practice the skills that are required to use this technological enhancement for exposure therapy in a safe and effective manner.

### Project 2: SimCoach[10, 11]

SimCoach is an intelligent, interactive, online, VH healthcare computer program that is being designed to provide support, encouragement, and direction to relevant online content for users, as well as to facilitate the process of seeking live provider care and treatment options. The SimCoach VH experience is designed to attract, engage, and assist Service members, Veterans, and their families in accessing healthcare information. SimCoach is also being designed to support users in making a decision as to whether they will take the first step toward initiating psychological care with a live provider. It is not meant to take the place of face-to-face healthcare, but to motivate users to take the first step toward seeking help, if needed.

SimCoach is intended to foster comfort and confidence by promoting users' efforts to understand their situations better, to explore available support options, and initiate treatment when

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[8] Project contact: Institute for Creative Technologies, University of Southern California, Los Angeles, CA.
[9] Project Status as of August 2011: Started 10/2010 and not currently completed.
[10] Project contact: Institute for Creative Technologies, University of Southern California, Los Angeles, CA.
[11] Project Status as of August 2011: Mid stage development, not yet deployed

appropriate. Users will be able to have a flexible interaction with the VH by typing text, clicking menu options, and through limited spoken interactions. It is a web-based system that does not require downloadable software. The program will "remember" their past dialogue, allowing users to return to the program and complete this interaction at their convenience. SimCoach is also capable of administering some simple neurocognitive and psychological testing to increase the accuracy of SimCoach's output to users and to better guide the delivery of initial referral options. Coordinating this experience will be a VH, selected by the user from a variety of characters (a female aviator, a male "battle-buddy," and a male retired Sergeant Major), who will answer direct questions and/or guide the user through a sequence of user-specific questions, exercises, and assessments. This interaction between the VH and the user will provide the system with the information needed to guide users to the appropriate next step of engagement with the system or to initiate contact with a live provider. Users will also be able to print out a summary of the computerized sessions to bring with them when seeking in-person clinical care.

A fundamental challenge of the SimCoach project will be to better understand the diverse needs of the user base such that appropriate individual user experiences can be designed to promote better healthcare access. At the most basic level, there are immense differences in the needs of Service members and their families. Further, there are likely large differences in the level of awareness users will have of existing resources and in their own need/desire to engage such resources. Within the Service members population itself, there is a high likelihood that individual users will have had very diverse combat experiences, help-seeking histories and consequent impact on significant others. The net result of attempting to engage such a diverse user base is that the system will need to be able to employ a variety of general strategies and tactics to be relevant to each individual user.

**Project 3: JESSEY**[12, 13]

JESSEY is a highly interactive personal computer videogame application with voice interactive capability for educating Service members about the needs and availability of mental healthcare and to familiarize the user with the military mental healthcare process. The goal is to educate the user about exploring mental health options for themselves or others, and to familiarize the user with available treatment options. The game will strive to make users more likely to recognize mental health issues and seek treatment for themselves, their colleagues, and family members. In addition to the active-duty population, the application should be expandable to the VA and civilian populations.

Although JESSEY is utilizing state-of-the-art commercial game technology, it is not a game. JESSEY leverages this technology because the game community currently possesses the highest quality tools and most rapidly evolving expertise for creating 3D virtual worlds and VHs.

JESSEY is a fictional female war hero, returning from Iraq and suffering from PTSD. She is selected to create immediate sympathy and attachment, and to demonstrate strength inspired by war heroes. JESSEY can be changed into entirely different avatars (her virtual image and back-story can be changed), but the initial system prototyping will focus on a single avatar before

[12] Project Contact: Total Immersion Software, Inc. (Alameda Office)
[13] Project Status as of August 2011: Initial SBIR Phase I development, moved to Phase II SBIR

additional content is created. JESSEY's dialogue will be written so it can apply to both a returning Veteran or family/significant others of either gender.

The JESSEY software can be obtained via download or disc. Once launched, the user will be introduced to the program by the chosen interactive virtual agent. JESSEY then gathers basic information from the user such as age, sex, military status, obtains information on PTSD symptoms using the PTSD Symptom Scale Self-Report (PSS-SR), and then asks questions to determine what event experience bothered them the most in the past month. The user can then pick a JESSEY to talk to (only the female JESSEY is available in the prototype) or create someone else to talk to. The user will then be able to ask the interactive virtual agent questions regarding the agent's PTSD. The user has control, conducts a guided conversation, and is given options of questions they could ask. The same format is employed for the user to discuss their symptoms with the agent. JESSEY will ultimately end the session by thanking the user for their involvement, reminding the user that PTSD can be treated, connect them with immediate support, or explain that help is available and can be tailored for their needs. This software harnesses gaming motivation to encourage users to continue interacting with this software more than once.

**Project 4: Virtual Officer Leadership Trainer (VOLT) and the Immersive Naval Officer Training System (INOT)[14, 15]**

VOLT and INOTS are skill-based training environments designed to support instruction, practice, and assessment of interpersonal communication skills. These systems may be leveraged to support mental healthcare professional training. The goal of VOLT and INOTS are to help new officers interact and provide guidance to subordinates who are experiencing performance and/or personal problems. To achieve this goal, the current system combines VH technology, state-of-the-art mixed reality, and blended classroom training solutions driven by an evidence-based instructional design framework.

The VOLT/INOTS systems are first and foremost training experiences founded on evidence-based instructional design. To develop the instructional design, project creators conducted expert interviews through Cognitive Task Analysis (CTA). They also reviewed the research literature regarding best-case practices for teaching interpersonal communication skills. The CTA methods for gathering expert processes and decision-making provide concrete strategies, concrete skills to support the strategies, dialogue examples linking the skills and strategies, and an organizational framework for teaching and assessing the skills. The skills and strategies for VOLT/INOTS are geared toward counseling a subordinate. Strategies and skills include effective active listening techniques and recognizing non-verbal cues that should trigger specific responses from the human role-player.

VOLT/INOTS training is relevant for mental healthcare professionals and others acting in support roles addressing difficult mental health issues. In fact, interpersonal skills training is a critical need identified by the DoD Task Force report on the Prevention of Suicide by Members of the Armed Forces. Recommendations include emphasis on relationship building between

[14] Project Contact: Project Director Institute for Creative Technologies.
[15] Project Status as of August 2011: Mid stage development, not yet deployed

supervisors and subordinates, practice for supervisors prior to assuming their appointments, and training for friends, family members and clergy who may have contact with distressed military personnel[16].

The current solution for suicide prevention training and other mental healthcare related issues leverages VH role-play interactions along with blended learning environment and instructor assessment tools. This method is to identify current gaps in the existing curriculum or training program and design instruction to address those gaps. In the case of VOLT/INOTS, role-play sessions with novices were the only practice that new officers were receiving prior to assuming their assignments. Role-play with novices, however, will be inconsistent, and may not present opportunities for practicing all of the target skills. Additionally, feedback following role-play sessions will also be inconsistent without an organizational framework that identifies the appropriate skills and strategies required to reach a successful outcome.

To address these gaps, the current project has developed classroom instructional support materials that provide scenario-based lessons, concrete examples of strategies, actions, and dialog to implement the strategies, part-task practice vignettes, and practice sessions with the VH role-play interaction. One trainee is chosen to interact with the VH and this trainee's response drives the experience. The rest of the class follows along and makes decisions on how they would respond by choosing from a menu of options and voting using personal response devices or "clickers."

An Instructor Control Panel (ICP) has also been created to assist the instructor managing the VH role-play interaction and the classroom response data. The ICP allows for video playback of the virtual human-to-human interaction in order for the class to evaluate body language and tone of the trainee in the After Action Review (AAR). The ICP tracks the conversation in real-time, using a script dialog and branching visuals for determining how the trainee in the immersive environment fared during the interaction. Visual aids in the form of bar graphs show group performance in the classroom, while a seating chart shows individual performance in the classroom. Suggested instructor agenda topics appear in the AAR tab so that instructors are guided through AAR discussion with hints for addressing relevant information based on a percentage of the class missing a decision point.

The underlying technology of the VOLT/INOTS platform is scalable to facilitate the inclusion of professional healthcare communication strategies and practices identifying and responding to an individual's signs of distress. The creators have developed mature technology, which may be leveraged to provide training and practice for first line supervisors and military mental healthcare professionals. Multiple scenarios may be developed to meet a variety of needs (e.g., one interaction may be with a VH subordinate in need of help, and another may be with a more senior Non-Commissioned Officer where the trainee practices making a plan to respond to the issue using the chain of command and appropriate procedures).

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[16] United States Department of Defense (2010). The challenge and the promise: Strengthening the force, preventing suicide and saving lives: Final report of the Department of Defense Task Force on the Prevention of Suicide by Members of the Armed Forces. Retrieved from www.health.mil/dhb/downloads/Suicide%20Prevention%20Task%20Force%20final%20report%208-23-10.pdf

The VOLT/INOTS systems are cost-effective alternatives to using human role players. The systems may be used in their current states or may be refined to target specific training scenarios. Using a VH role-play interaction offers a safe environment for mental healthcare professionals to practice their skills prior to assuming their assignments. The blended learning environment allows for training many people simultaneously, and the instructor support tools defined earlier help manage and display the information in a meaningful way for both instructors and students. The instructional support materials may also be delivered on mobile platforms for easy dissemination.

**Project 5: The Stress Resilience in Virtual Environments (STRIVE) Project**[17, 18]

Resilience is the dynamic process by which individuals exhibit positive adaptation when they encounter significant adversity, trauma, tragedy, threats, or significant sources of stress[19]. Stress resilience training prior to deployment represents a new direction for the reuse of the core *Virtual Iraq/Afghanistan* simulation assets. The STRIVE project aims to create a set of combat simulations, derived from the *Virtual Iraq/Afghanistan* project that can be used as contexts for the experiential learning of cognitive-behavioral emotional coping strategies in Service members prior to deployment to better prepare them for the types of emotional challenges that are inherent in the combat environment.

Recently, the DoD has focused significant attention on the concept of "Stress Resilience Training" with a variety of programs being developed for this purpose across the branches of the military[20]. Perhaps the program that is attempting to influence the largest number of Service members is the *Comprehensive Soldier Fitness* program. This project has created and disseminated training that aims to improve emotional coping skills and ultimate resilience across all Army Service members. One element of this program draws input from principles of Cognitive Behavioral therapy/science, which generally advances the view that it is *not* the *event* that causes the *emotion*, but rather it is how a person *appraises* the event (based on how they *think* about the event) that leads to the emotion[21]. From this theoretical base, it then follows that internal thinking or appraisals about combat events can be "taught" in a way that leads to more healthy and resilient reactions to stress. This approach does not imply that people with effective coping skills do not feel some level of "rational" emotional pain when confronted with a challenging event that would normally be stressful to any individual. Instead, the aim is to teach skills that may assist soldiers in an effort to cope with traumatic stressors more successfully and achieve post adversity growth from their experiences in combat.

The use of STRIVE prior to deployment will involve immersing and engaging Service members within a variety of virtual "missions." These missions will offer emotionally challenging situations that provide a more meaningful context in which to learn and practice cognitive coping strategies that better psychologically prepare them for combat. To accomplish this, STRIVE is

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[17] Project Contact: Institute for Creative Technologies, University of Southern California, Los Angeles, CA.
[18] Project Status as of August 2011: Project creation just initiated
[19] Luther, S., Cicchetti, D., & Becker, B. (2000). The construct of resilience. Child Development, 71, 543-562.
[20] Bartone, P.T. (2006). Resilience under military operational stress: Can leaders influence hardiness. *Military Psychology, 18,* 131-148.
[21] Ortony, A., Clore, G. L., & Collins, A. (1988). *The cognitive structure of emotions.* New York, NY: Cambridge University Press.

being designed as a 30-episode interactive narrative in VR, akin to being immersed within a "*Band of Brothers*" type storyline (a television miniseries based on a book series depicting a company's real-life exploits during World War II) that spans a typical deployment cycle. At the end of each of the graded 5 to 10-minute episodes, an emotionally challenging event occurs (e.g., seeing grotesque human remains, death or injury of a fellow squad member, accidentally being responsible for the death or injury of a civilian child). At that point in the virtual experience, the virtual world "freezes in place" and an intelligent VH "mentor" (previously selected by the user) emerges from the midst of the chaotic VR scenario to guide the user through rational restructuring exercises for appraising the virtual experience, drawing on content already employed in the standard classroom-delivered DoD stress resilience training programs.

**Project 6: The Warrior's Journey Activity with the Story Telling Agent**[22, 23]

The Warrior's Journey, also called the Coming Home Project, is exploring new ways to bridge the divide between returning Service members and Veterans who need mental health services and those who actually receive that help. The Warrior's Journey is designed as a healing activity in the online virtual world Second Life (an online virtual world with features that mimic real life) for returning warriors, using concepts from narrative psychology (a stance within psychology concerned with how individuals construct stories and endow them with meaning). It is designed to help them see their experiences in relation to stories of honorable warriors throughout history. In making the stories about warriors, a context has been set that each Service member or Veteran can identify with, given the strong ideals they adhere to as part of their warrior culture. Three essential overlapping core values common to all branches of the military are courage, honor, and selfless service/duty. The stories are chosen from historical warriors to reinforce these concepts. Stories are powerful constructs that resonate in both those that tell them and those who hear them. Further, writing one's own story can provide a sense of control for how the story is presented, what details are kept, which are downplayed or eliminated, and ultimately how the story is internalized and remembered.

The current narrative activity takes place in a story tower (a virtual environment that looks like a tower), where the participant is introduced to a historical Cheyenne warrior known as the "Dog Soldier." The participant walks up a circular path and hears the warrior speaking while viewing paintings depicting his life. Upon reaching the top of the tower, the participant can chat directly with the Dog Soldier in the form of an avatar agent. This Dog Soldier is an intelligent conversational storytelling agent that moves his lips and gestures when speaking. He can answer any questions concerning his life, the environment and his identity as a warrior. In addition to chat, it is also possible to use voice to question the Dog Warrior using a suite of applications developed by the project creators. A second Warrior's Journey story about a Samurai warrior who finds his way back to civilian life after an injury is also being worked on.

After experiencing these two classic warrior's stories, the participant earns the right to author their own warrior's journey story for the tower, using a custom-made authoring system closely connected to Second Life. This system elicits a positive story from the Service member or Veteran using known storytelling frameworks, and provides for the uploading of photographs,

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[22] Project Contact: http://tinyurl.com/warriorJourney

[23] Project Status as of August 2011: Operational: can be accessed in Second Life now

and voiceovers or text, as well as the creation of the Service member's or Veteran's own storytelling agent avatar. This agent will act the same way as those designed for the classic warrior stories, and the Service members or Veteran creates the backend knowledge of the agent through the authoring tools made by the project creators. When the story and agent are ready, this newly authored Warriors' Journey will become available as a selection when a visitor enters the tower.

**Project 7: National Center for Telehealth and Technology (T2) Virtual PTSD Experience**[24, 25]

The T2 Virtual PTSD Experience is an immersive, interactive learning experience designed by the DoD T2 to educate visitors about combat-related PTSD. It features a simulation demonstrating how PTSD may be acquired during a combat-related traumatic event, including an explanation of the connections between danger cues and triggers, the role of avoidance in the development of PTSD, and how stress reaction is a normal human response to traumatic events. Additionally, this environment features simulations of PTSD symptoms, helping the visitor learn through interactive activities how PTSD symptoms may show up in a person's life and how they may interfere with functioning. Finally, the environment includes information to help visitors determine whether they or a loved one is in need of care, and how to access that care, whether a DoD or Department of Veterans Affairs (VA) beneficiary.

As is the case with most U.S. state parks, the Visitor's Center is the starting place for the T2 Virtual PTSD Experience. Upon arrival, visitors immediately encounter information about the purpose of the environment. Additionally, they are advised that the environment is not designed to be an intervention for visitors in crisis, and they are offered contact information for more appropriate services, such as the National Suicide Prevention Lifeline, the Defense Centers of Excellence (DCoE) for PH and TBI 24/7 Outreach Line, and calling 911 emergency services. The Visitor's Center also includes a small video theater featuring an overview video of the T2 Virtual PTSD Experience, a 3D map of the environment with key features highlighted, a "brochure rack" with each brochure being clickable to link to external PTSD web resources, and miniature dioramas of the three major segments of the T2 Virtual PTSD Experience.

In terms of an interactive virtual agent, Ranger Jane is a VH with basic artificial intelligence capable of responding to basic questions about the environment and PTSD. She mans the information desk on the north side of the Visitor's Center. Jane's logs are reviewed regularly by administrators to update and improve her ability to answer questions posed by visitors for which she did not previously have an answer. In this way, Jane's database of information grows as more visitors interact with her, making her more helpful to future users.

**Project 8: Post-Traumatic Stress Disorder (PTSD)-SIM** [26, 27]

The goal of this program is to educate Service members about the needs and availability of mental health options, and to familiarize the user with the military mental health process. This

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[24] Project contact: National Center for Telehealth and Technology (T2), Joint Base Lewis McChord, Tacoma, WA http://maps.secondlife.com/secondlife/T2 PTSD Education/133/196/29

[25] Project Status as of August 2011: Launched January 18, 2011; Can be accessed in Second Life now

[26] Project Contact: Total Immersion Software, Inc. (Alameda Office)

[27] Project Status as of August 2011: Mid stage development, not yet deployed

free, game-like software experience will allow users to recognize mental health issues and seek treatment. In addition to the Service member population, the application will have the ability to be expanded to the civilian population.

PTSD-SIM is entering Phase II of a two-year effort, executed out of the US Army Telemedicine and Advanced Technology Research Center (TATRC). Phase I of this effort developed an actionable model to address the need for such a system. Phase II is evolving Phase I learning into full production of a prototype system called *StressSim*.

PTSD-SIM is informed by leading experts in the post-traumatic stress field and incorporates the Clinician-Administered PTSD Scale (CAPS), the Gold Standard for PTSD evaluation, presenting it in a user-friendly way through a computer avatar who destigmatizes PTSD. Avatar questions are used to obtain symptoms, CAPS criteria are mapped to animations that the Service member or Veteran might be experiencing, and CAPS scoring is used to activate appropriate animations when the user is permitted to question the avatar and see personal symptoms displayed in a "PTSD mirror". The accompanying revelation of PTSD symptoms in the user is used as a call-to-action, ultimately taking him/her to a links page that permits safe and confidential access to existing support Web sites designed to aid in recovery.

PTSD-SIM will provide single user interaction on a stand-alone, modestly powered personal computer with the software installed via a free internet download from a government managed portal, like the Healing Heroes web site, with intuitive controls supported throughout. The resulting software will be subject to Usability and Effectiveness Validation Studies at a later stage of development. Field testing will be conducted with the selected Service members and Veterans. The final software will be modified to reflect the feedback obtained from those who work on the front lines of PTSD treatment.

**Project 9: Video Doctor**[28]

Video Doctor is an anonymous, web-based program that gives Service members and their families the opportunity to consult with a virtual doctor from their computer about issues related to mental health and alcohol use disorders. By simulating a doctor/patient conversation, the actor portraying Video Doctor guides participants through a series of questions about their emotional well-being and their readiness to seek help. The program also provides self-care tips and recommendations on how and where to access mental health resources. The Video Doctor modules are offered as an option for those who screen positive after taking on-line mental health self-assessments for Depression, PTSD, and Alcohol abuse on the www.militarymentalhealth.org website. The module for Generalized Anxiety Disorder is currently being developed.

## IV. Conclusion

This report presents information on nine DoD-sponsored projects using virtual agents in mental health care. The projects are designed for different audiences in order to accomplish: (1) training for first level care for mental health issues, (2) offer information and feedback on various mental

[28] Project Contact: Psychological Health Strategic Operations. Force Health Protection and Readiness Programs

health issues to reduce barriers to seeking care, or (3) offers resilience training to deploying Service members.

While the systematic use of interactive virtual agents or VHs in healthcare is still relatively new to providing Service members, Veterans, and their families a new way to seek confidential help, it is hoped it may encourage help-seeking behavior with a live provider, if needed. These projects are nascent efforts in a largely unresearched area. Empirical support for effectiveness is needed, yet in spite of the current limits of the technology and research support, such approaches are innovative and highly clinically relevant.

## Appendix 1 – Legislation

Report to Congress on the Outreach Tools Using an Interactive Virtual Agent in Response to House Armed Services Committee Report (H.R. 5136) 111-491 of the National Defense Authorization Act for Fiscal Year 2011, Page 317

Outreach Tools Using an Interactive Virtual Agent

The committee is aware that the Department of Defense has considered using interactive virtual agents on either websites or standalone computers to help reduce barriers to individuals seeking mental healthcare. The committee directs the Secretary of Defense to submit a report to the congressional defense committees on all healthcare related projects or programs that use an interactive virtual agent not later than 90 days after the date of enactment of this Act.

## Appendix 2 - Projects Referenced in Report to Congress

| Project | Project Developer |
|---|---|
| Military VP's for Training on Depression/Suicide Issues and for PTSD Exposure Therapy Training | Institute for Creative Technologies/ University of Southern California |
| SimCoach | Institute for Creative Technologies/ University of Southern California |
| JESSEY | Total Immersion |
| VOLT & INOTS | University of Southern California Institute for Creative Technologies |
| STRIVE | Institute for Creative Technologies/ University of Southern California |
| Warrior's Journey Activity with the Story Telling Agent | University of Southern California Institute for Creative Technologies |
| PTSD-SIM | Total Immersion |
| T2 Virtual PTSD Experience | National Center for Telehealth and Technology |
| Video Doctor | Psychological Health Strategic Operations, Force Health Protection and Readiness Programs |